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WEBGIS PORTAL FOR CROP DIVERSIFICATION IN HIMACHAL PRADESH

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ABSTRACT

Crop diversification has been recognized as an effective strategy for achieving the objectives of food and nutritional security, income growth, judicious use of land and water resources, increase in external input use efficiency and thus, sustainable agricultural development and environmental improvement. In addition to traditional practices for crop diversification, use of modern technologies is also being envisaged as inevitable including geospatial technologies. These technologies (Remote sensing and GIS) have emerged as an effective tool for the macro and micro level mapping & planning of natural resources encompassing agriculture. Himachal Pradesh being a state with highly diversified terrain ranging from low hills to high mountain ranges has provided a challenge in agriculture from further enhancing and utilising the latest technologies as compared to the rest of the states. In this study, number of spatially spread project sites had been chosen for which spatial databases of project sites had been prepared such as project area, khasra boundaries, contours, soil type, land use/cover etc. The study provided an extensive inventory of the assets (proposed and actually constructed) on the field in various project sites which can be accessed and reviewed using the internet by the funding/implementing agencies and the stake holders (beneficiary farmers) at the project sites. A web based GIS portal had been developed using the ESRI Arc server web services technologies which can be updated and queried for any project site and the information including geotagged images can be gathered for any particular asset in the sub-project site. The portal thus developed provides transparency and can be used to easily check the various activities being carried out under each sub-project site. This type of methodology is first of its kind in the state under which the model is being framed to carry out micro level mapping for agriculture.

KEYWORDS: GIS, ArcServer, WebGIS Portal, Agriculture

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Original Article

INTRODUCTION

Literature Survey

Crop diversification in India is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops. It results in promoting the shift from traditional agricultural practices to much more diversified agriculture. Crop area diversification essentially advocates moving away from growing a single crop to a number of crops in different combinations in the same piece of land, as explained by Hazra, C.R. (2001). Bernard, A.et.al,(2003) in the early days of geospatial technologies described about the DSS as is an Integration of Web-Based Programs, Geographic Information Systems (GIS) Capabilities and Databases. Inés Santé a, et al. (2004) also worked on GIS web-based tool for the management of the PGI potato of Galicia. Irene Compte, et al. (2004)

enlisted a WEBGIS application for designing agricultural plantations and installations. Ioannis M. et al. (2004) utilized GIS as an Open System for Organic Agriculture Administration, Verification and Planning. Web GIS has the Potential to share data, provide easy access for users with limited GIS Knowledge was given by Mathlyalagana, V.et.al,(2004). Haiyan, Xu et al. (2005) constructed Digital Information Platform based on WebGIS for Safety Vegetable Production. Xu Haiyan, NieYimin (2005) gave a model as GIS Based Decision Making System for Agriculture. David,H.et al (2006) detailed Web –Based Systems as a platform where Client can use any internet Connected computer or web – enabled Mobile Phone or PDA to gain Real time Access to the data. Gupta, Y.K., Grunwaldb,S. . Gupta, R.D., Kumar, K, (2005). WebGIS for Planning Infrastructural Facilities at Village Level. Vanmeulebrouk, B. Melman D. Schotman, A.(2009) used Open Source and Proprietary software to Optimise meadow bird management schemes in Netherlands. Bandyopadhyay,S Jaiswal,. Hegde, R. K. at al. (2009) used GIS and remote sensing approach for assessment of land suitability potentials for agriculture El-Kawy, R. Abd, at al. (2010) developed GIS-based Land Evaluation Model for Agricultural Land Suitability Assessments in Arid and Semi Arid Regions. Choudhury, B. U. (2013) harnessed geo-spatial tools for agricultural area and Crop diversification. Many other scientists used these geo-spatialtools through open source and commercial GIS based softwares. GIS software is tool, and it is not a target. The target is the geodatabase, precisely, the geospatial part of geodatabase not the tabular part. (https://www.researchgate.net)

Study Area

Himachal Pradesh (HP) in India, situated in the Western Himalayas, has majestic mountains, fertile valleys, perennial rivers, precious forests, invaluable flora and fauna, tremendous wealth of resources, minerals, very rich culture and diverse customs and manners. The state of Himachal Pradesh is situated between 30° 22′ 44″ to 33° 12′ 40″ N latitude and 75° 45′ 55″ to 79° 04′ 20″ E longitude (Figure 1) and occupies an area of 5.57 million ha

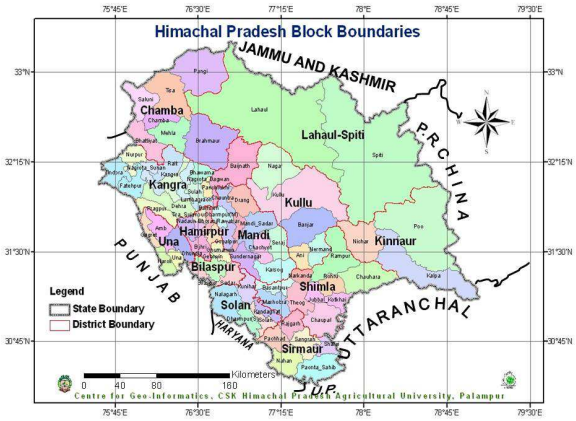

Figure 1: Block Level Administrative boundaries of Himachal Pradesh

Himachal Pradesh is a hilly state with a general increase in elevation from west to east and south to north ranging from 300 m to 6000 m. One-third of its area remains snow covered for about seven months in a year. This snowy part of the state is the source of three major rivers – Beas, Ravi, and Chenab, while Satluj and Yamuna Rivers originate from Tibet and Yamnotri, respectively. Its climatic conditions vary from extremely hot to severe cold regions like Chamba, Kinnaur and Lahaul-Spiti. Dharamsala and Palampur in Kangra district receive the highest precipitation next to Chirapunji (highest rainfall in the world), while areas like Spiti almost have no rainfall during the winter season.

The HP Crop Diversification Project aims at promoting crop diversification in the target area of five districts (Bilaspur, Hamirpur, Kangra, Mandi and Una) in the State of Himachal Pradesh, through development of necessary infrastructure such as irrigation facilities and farm access roads, alongwith develop or rehabilitate existing facilities in approximately 210 irrigation schemes in the area to bring additional area of 3,712 ha. under assured irrigation, and will construct or improve 100 km of 147 access farm road etc. In order to see all the project sites along with their activities (taken or accomplished), there was requirement of GIS based Single Window System and later on use the system for monitoring. Remote sensing and GIS has emerged as an effective tool for the macro and micro level mapping of natural resources. With the increased resolution in RS data the accuracy in mapping has increased multifold and further these data may be uniformly overlaid on the geographical maps of the region or locality with various GIS packages. In order to have people's viewpoint in the validation of ground level truths and actualization of planning and management of natural resources the PRA/RRA (Participatory Rural Appraisal/ Rapid Rural Appraisal) exercises are very useful. These exercises are helpful in identification of the sites for the construction of water harvesting structures, mapping the potentiality of the natural resources and most important thing is that it ensures people's participation in the management of natural resources. Thus, the participatory RS and GIS is the need of hour for micro level planning and management.

OBJECTIVES

The major objective of the study was to provide an online solution that can provide spatial information that could be used for planning and monitoring crop diversification. The purpose of deploying GIS tools was for developing location specific information system for what is where and monitoring & evaluation. In order to deliver the solution, WEBGlS Portal was to be developed and used as an interactive platform for regular updation of the spatial and non-spatial datasets for the 210 sub projects located in five districts of Bilaspur, Hamirpur, Kangra, Mandi, and Una of Himachal Pradesh, India with following specific deliverables:

- Generation of dynamic spatial data for all layers of Detailed Project Report (DPR) & their uploading on WEB GIS Portal.
- Porting of completed DPRs' work, preparation of spatial data of all the actual constructed structures/assets generated
- Geotag images of structures/assets actually constructed at project sites or any other field data shall be incorporated in Web Portal.
- Monitoring of the implemented schemes over the time thereby identifying the GIS based change detection using time-series satellite imageries (depending upon availability of cloud free data of study area/season) or using Khasra wise attribute data of the study area.

METHODOLOGY

Geo Database Generation Flowdiagram:

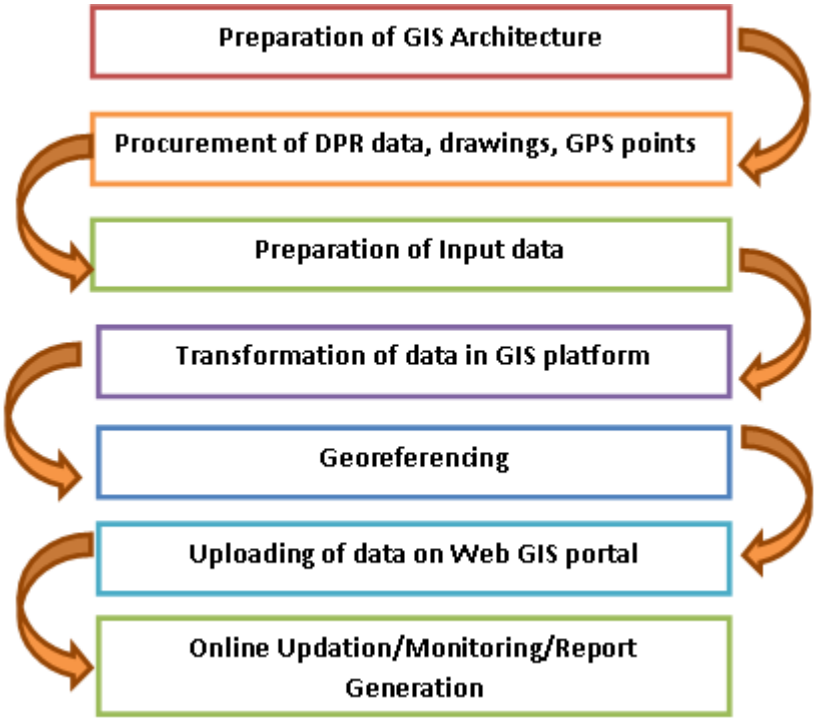

Figure 2: Development of Web GIS Portal

Open source and professional softwares may be deployed to achieve the objectives. To enhance the geospatial experience, the team implemented ArcGIS Server that maintained and published datasets and geo tagged images and other important data attributes, ensuring better data visualization at the state and national levels. The spatial database infrastructure (SDI) needed to be framed which could handle query based requests from the various clients. The SDI shall enable the instant changes and updates from various nodes at Project Management Units(PMU) located at different geographic location one at each district. GIS architecture required a platform where data visualization can become easier and can enable systematic monitoring of the standardized datasets. The detailed action plan prepared by the PMU was required to be ported on the system. The SDI developed was required to enable the transformation from the DPR drawings from CADD outputs into the GIS architecture.

GIS Tools/Software Used

The study required an online solution to provide the spatial data that could be easily maintained and monitored at national and International agencies. Developing a system required maintenance of a dedicated database system that can easily incorporate the regular updates besides a mechanism of backups. The system in place also required the easy publishing of spatial datasets over the internet either in the form of WMS or WFS whichever was required at the later stages. Various web based open GIS solutions were explored like Mapserver, Chamleon, postgreSQL for designing and implementing the SDI for the study. The major shortcoming in going to the open source solution was requirement of experts in programing who can code and encode the spatial data with the database and display the theme based output. This required of building the map files which needs to be understood and symbols for each of the asset or feature that needs to be displayed needs to manually programmed. The study also required the geotag images to be linked with each asset and

this was not possible with open source solutions at one place. The storage of the media files in the database was a bit tricky to do and again required some expert programing skills. Since the study included 210 project sites and the programing of symbol in map file was a tedious task. The spatial database that was to be ported over the internet also required to be queried and updated form the client end (survey groups), this was also a bit tedious to do in open source solutions. The best solution that met the requirement of the study was Arc server. The advantage of using the arc server to port and publish the spatial data as service was its compatibility with arc map. Any project site was prepared in arc map and published directly on the server was easy to maintain and configure at any time as and when required. Some of the advantages of the SDI system built on arc server are as follows:

- Easy to port the existing shape file into the database.
- Required minimum programming skills
- Publishing of datasets at ease
- Geotagging of asset images and other document including media files.
- Publishing datasets in project reports without having to upload them on the map server each time.
- It helped the survey groups to save time and complete research within deadlines. The integration of the new software solution benefited users by regularly monitoring and providing updates for each agricultural asset.
- The overlaying Esri maps offered CGRT an interactive platform to perform analysis and identification of the sites.
- With ArcGIS Server, the surveyors centrally managed the geo-data to extract important asset information

RESULTS

WEBGlS Portal was developed and used as an interactive platform for regular updation of the spatial and non-spatial datasets for the sub project sites spatially spread over five districts of Himachal Pradesh, India

Features of WebGIS Portal

WebGIS portal that is designed and developed had following features:

- Generic State Information
- Selectable Project sites based on specific DPMU - BPMU
- Information of sub-project sites
- Information of individual layers and their attributes (namely Khasra Boundary, Chak Boundary, Contours, Nala(Source), Bouri, Channel, Desilting Chamber, Distribution Network, Foot Path, Head Weir/Check Dam, Junction, Outlets, Pump House, Rising Main, Road, Water Storage Tank etc) of sub-project sites.
- Each layer can be independently queried for identification and description.
- Miscellaneous Information for each project (namely Action Plan Map, Salient Features, Khasra wise details) is displayed alongside the project map.

- Relevant Drawings of project (Desilting Chamber, Distribution Channel, Main Channel, Outlets, Pump House, Water Storage Tank) are also displayed alongside the project map.

WebGIS Portal URL: *http://14.139.224.135:6090/cgrtgis/state/*

Outputs Figures/Maps

Figure 3: Main Login Window for Secure Access to Portal

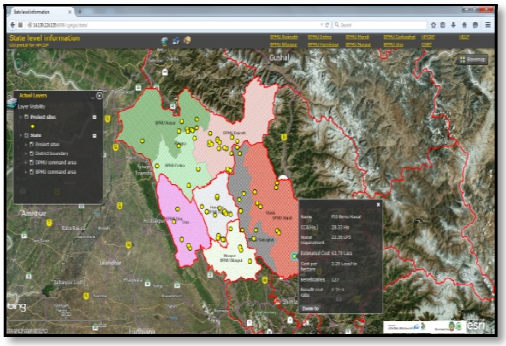

Figure 4: Project Sites and Attribute Data on One Click

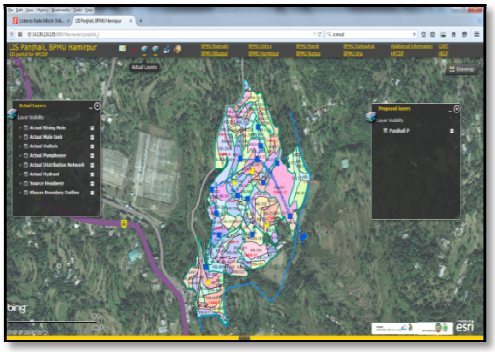

Figure 5: Action Plan Map (DPR) Ported for Each Project Site

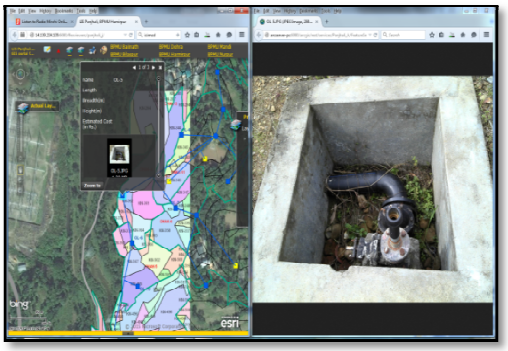

Figure 6: Geotagged Image of Actual Assets Tagged At Actual Location

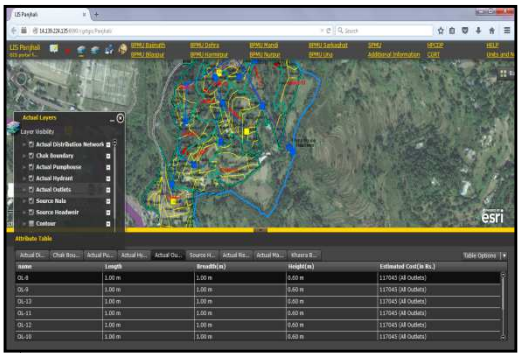

Figure 7: Client Side Update Option for Attributes

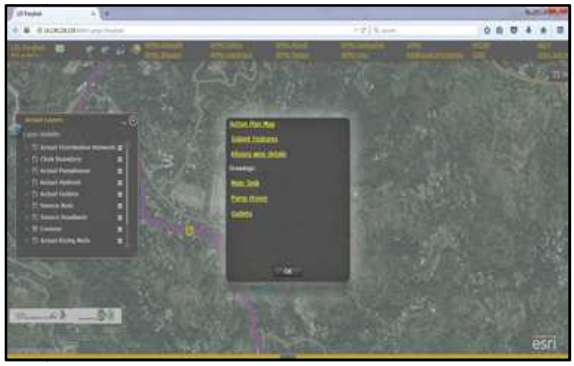

Figure 8: Additional Information of Project Sites

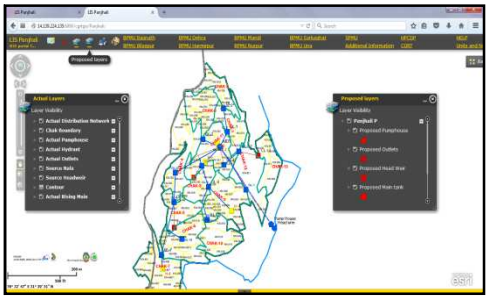

Figure 9: Monitoring Window for Proposed and Actual Assets

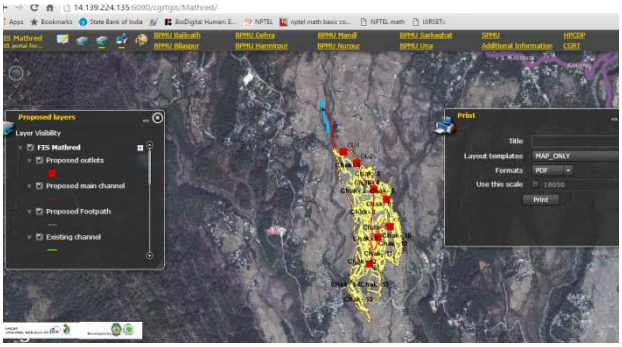

Figure 10: Print Full Sub-Site/ Assets in PDF/JPEG Formats

DISCUSSIONS

With the database (spatial and non-spatial) on the server, planning and execution requirements for crop diversification could be carried out effectively & efficiently. Moreover, monitoring of the work done/assets created could be done at a click away by the officials sitting anywhere anytime. The WebGIS based application provides following instant solutions:

- Systematic monitoring of standardized datasets
- Instant changes and updates, which could be made at any time even at the client's end
- Regular data backups using Postgre SQL
- Simplified republishing of changes at different project stages

There have been Web based portals for agriculture in pockets but such one portal at State/National level is not in place and much more initiatives are required to be taken up for the standardization and operationalization of the such portal.

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REFERENCES

1. *Hazra, C.R. (2001). Crop Diversification in India http://www.fao.org/docrep/003/x6906e/x6906e06.htm*
2. *Bernard, A.et.al,(2003) A DSS is an Integration of Web-Based Programs, Geographic Information Systems (GIS) Capabilities and Databases. Computers and Electronics in Agriculture 39, 241/249*
3. *Inés Santé a, Rafael Crecente a, David Miranda a, Juan Touriño b, Fernando Canzobre b (2004) A GIS web-based tool for the management of the PGI potato of Galicia. Journal of ELSEVIER, Computers and Electronics in Agriculture.*
4. *Irene Compte, Antoni Hernández, Francesco Marucci, Ferran Orduña (2004).SIGFRUT: A WEBGIS application for designing agricultural plantations and installations. Journal of ELSEVIER, Computers and Electronics in Agriculture.*
5. *Ioannis M. IFANIS, Avraam P. MAVRIDIS and Paraskevas D. SAVVAIDIS, Greece (2004). Internetic GIS: An Open System for Organic Agriculture Administration, Verification and Planning. Journal of Agriculture Science in Greece.*

6. *Xu Haiyan, NieYimin (2005). Constructing Digital Information Platform based on WebGIS for Safety Vegetable Production. Journal of Agriculture Science in Chinese (192): 108-112.*
7. *Xu Haiyan, NieYimin (2005). GIS Based Decision Making System for Agriculture. Journal of Agriculture Science in Chinese (214): 115-118.*
8. *David, H.et al (2006). Web –Based Systems, Client can use any internet Connected computer or web – enabled Mobile Phone or PDA to gain Real time Access to the data*
9. *Mathlyalagana, V.et.al,(2004). Web GIS has the Potential to share data, provide easy access for users with limited GIS Knowledge. Retrieved from http://soils.ifas.ufl.edu/wetlands/publications/pdf-articles/290*
10. *Gupta, Y.K., Grunwaldb, S. Gupta, R.D., Kumar, K, (2005). WebGIS for Planning Infrastructural Facilities at Village Level. Journal of ELSEVIER, Computers and Electronics in Agriculture.*
11. *Vanmeulebrouk, B. Melman D. Schotman, A.(2009). Application of Open Source and Proprietary software to Optimise meadow bird management schemes in Netherlands. International journal of Geographical Information Science, 20,8,885-898.*
12. *Bandyopadhyay,S Jaiswal,. R. K. Hegde V. S. and Jayaraman V. (2009). Assessment of land suitability potentials for agriculture using a remote sensing and GIS based approach' International Journal of Remote Sensing Vol. 30, No. 4, 20 February, 879–895.*
13. *El-Kawy, R. Abd, Ismail,,H.A Rød,.J.K. Suliman, A.S. (2010). A Developed GIS-based Land Evaluation Model for Agricultural Land Suitability Assessments in Arid and Semi Arid Regions. Research Journal of Agriculture and Biological Sciences, 6(5): 589-599, INSInet Publication.*
14. *Choudhury, B. U.,Sood, A., Ray, S. S., Sharma P. K., Panigrahy, S. (2013). Agricultural Area Diversification and Crop Water Demand Analysis: A Remote Sensing and GIS Approach; J Indian Soc Remote Sensing Vol 41(1):71.*
15. *Arcgis-server-vs-open-source-software:http://gis.stackexchange.com/questions/1288/arcgis-server-vs-open-source-software*